

REMARKS

Claims 9-41 are pending in the present application.

Applicants have amended the specification as follows: to accommodate the Examiner's suggestion on page 4 of the Office Action; to correct a typographical error on page 12; to provide additional support for the photoinitiator limitation of new claims 10 and 26; and to include the chemical name of Irgacure 907 in Formulation 1.1 at the bottom of page 27. No new matter has been added.

Claims 1-4 and 7 have been withdrawn as being drawn to a non-elected invention. Applicants have cancelled claims 5, 6 and 8, without prejudice.

Applicants have added new claims 9-41. Support for these new claims can be found in the specification on page 3, line 2 to page 5, page 6, line 4 to page 7, line 6; page 10, line 26 to page 14, line 1; and the examples. Accordingly, the new claims contain no new matter.

I. Restriction Requirement

The Examiner has required restriction to one of the following inventions:

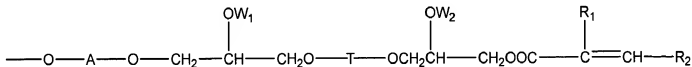
- Group I: claims 1-4 and 7, drawn to an epoxy acrylate of formula (III) and its process of preparation; or
- Group II: claims 5, 6 and 8, drawn to a carboxyl group-containing epoxy acrylate of formula (IV) and its process of preparation.

During a telephone conversation with Applicant's representative on December 11, 2002, a provisional election was made to prosecute the invention of Group II, claims 5, 6 and 8. Applicants presently affirm the provisional election and hereby elect Group II, claims 5, 6 and 8, drawn to a carboxyl group-containing epoxy acrylate of formula (IV) and its process of preparation. Claims 1-4 and 7 have been withdrawn.

II. Rejection under 35 U.S.C. § 112, First Paragraph

Claims 5, 6 and 8 stand rejected under 35 U.S.C. § 112, first paragraph, for allegedly failing to provide enablement for "n" being unconditionally "0". Applicants have obviated this rejection by amending the specification on page 12, after line 6, by adding the following paragraph according to the Examiner's suggestion:

If n in formula IV is 0, then X is hydrogen and Y is the group of the formula



While claims 5, 6 and 8 have been cancelled, new independent claims 9 and 25 contain the foregoing limitation. Applicants request that this rejection be withdrawn.

III. Rejection under 35 U.S.C. § 112, Second Paragraph

Claim 8 stands rejected under 35 U.S.C. § 112, second paragraph, as allegedly being indefinite. Applicants have obviated this rejection by canceling claim 8 and by reciting new claim 25 as a method for the preparation of a photoresist formulation comprising process steps. Applicants request that this rejection be withdrawn.

IV. Rejection under 35 U.S.C. § 102(a) or, in the alternative, under 35 U.S.C. § 103(a)

Claims 5, 6 and 8 stand rejected under 35 U.S.C. § 102(a) as anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as obvious over Japanese Patent No. 5-32746 ("JP '746").

Claims 5, 6 and 8 have been cancelled. Newly added claims 9-41 are directed to a carboxyl group-containing epoxy acrylate in which the carboxylic acid is succinic acid, and in which the epoxy acrylate of formula III has been reacted with succinic acid anhydride to produce the corresponding carboxyl group-containing epoxy acrylate of formula IV.

JP '746 does not disclose or suggest succinic acid or its anhydride as the polybasic carboxylic acid or anhydride, respectively. Rather, JP '746 discloses "maleic acid, phthalic acid, tetrahydrophthalic acid, hexahydrophthalic acid, HEAD acid and anhydrides of these acids." (JP '746 at page 16, lines 3-5).

Applicants respectfully submit that JP '746 cannot anticipate the presently claimed invention since JP '746 fails to teach each and every element of the presently claimed invention. JP '746 does not teach a photoresist formulation comprising a carboxyl group-containing epoxy acrylate of formula IV and a photoinitiator wherein the cyclic anhydride of the polycarboxylic acid is succinic anhydride. Nor does JP '746 teach a method of making a photoresist formulation

comprising the step of mixing a carboxyl group-containing epoxy acrylate of formula IV with a photoinitiator wherein the cyclic anhydride of the polycarboxylic acid is succinic anhydride.

Moreover, Applicants respectfully submit that it would not be obvious to one of ordinary skill in the art to modify the resin taught in JP '746 to include succinic acid as the carboxylic acid or to react the epoxy acrylate of formula III with succinic acid anhydride because succinic acid anhydride provides surprisingly and unexpectedly superior results as compared to the anhydrides disclosed in JP '746.

Applicants have conducted comparative tests that demonstrate the surprising advantage and superiority of succinic acid anhydride versus maleic acid anhydride in carboxyl group-containing epoxy acrylates used in photoresist resin compositions. Attached please find the Declaration of Dr. Roger Salvin, co-inventor of the above-referenced application. The comparative tests show the formation of a carboxyl group-containing epoxy acrylate of formula IV from an epoxy acrylate of formula III, RT 1743, by three different synthesis routes. (Declaration, paragraphs 10-14). Surprisingly, when the epoxy acrylate of formula III, RT 1743, was reacted with maleic acid anhydride according to the method described in example 15, pages 25 to 26 in the above-referenced application and according to the method described in JP '746, the yield was a gel-like material that was insoluble and could not be further processed as a photoresist resin. (Declaration, paragraphs 11-12). When the epoxy acrylate of formula III, RT 1743, was reacted with succinic acid anhydride according to the method described in example 15, pages 25 to 26 in the above-referenced application, the product could be processed as a photoresist resin without any problems. (Declaration at pages 5-6, paragraph 13). These surprising, unexpected results rebut a prima facie case of obviousness.

Applicants respectfully request that the 102 and 103 rejections be withdrawn.

V. Certified Copy of Priority Document

The Office acknowledges a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f), yet states that no certified copies of the priority documents have been received. Applicants respectfully submit that a certified copy of the Swiss priority application Serial No. 2003/93-0 was filed in the parent application Serial No. 08/268,094 on August 17, 2001. Attached please find a copy of the priority document. Applicants respectfully request that the Examiner acknowledge receipt of same and indicate in the next Office Action that Applicants' claim for foreign priority has been perfected.

CONCLUSION

Applicants believe that the present application is now in condition for allowance. Favorable consideration of the application as amended is respectfully requested.

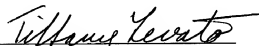
The Commissioner is authorized to charge any fee due, or credit any overcharge as a result of this Amendment and Response to Deposit Account No. 16-2500.

Respectfully submitted,

Proskauer Rose LLP

Date: August 27, 2003

By


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Serial No.: 09/932,731
Attorney Docket: 75248-008

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of:

ROTH, Martin et al.

Serial No.: 09/932,731

Filed: August 17, 2001

For: EPOXY ACRYLATES

Group Art Unit: 1712

Examiner: R. Sellers

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TC 1700

DECLARATION UNDER 37 C.F.R. §1.132

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

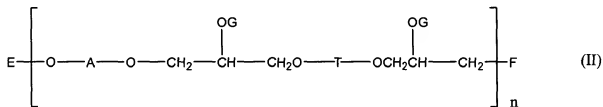
I, Dr. Roger Pierre Salvin, declare the following:

1. I am Dr. Roger Pierre Salvin, a citizen of Switzerland, residing in Weil am Rhein, Germany.
2. I was awarded the degree of Doctor in Natural Sciences by the University of Mulhouse, France in 1976.
3. I have been employed by Vantico AG (previously the "Performance Polymers" Division of Ciba SC) as a Chemist since 1984 and presently hold the position of IP Manager in the value sector of Optronics.
4. I have been engaged in research in the field of Photoresists for Vantico AG and Ciba SC since 1984.
5. I am a co-inventor of the invention described in U.S. Serial No. 09/932,731.

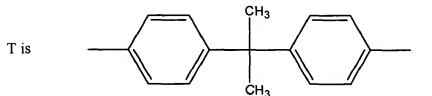
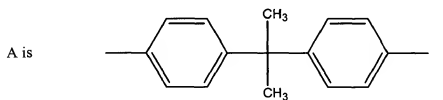
6. I have reviewed the Office Action dated February 27, 2003, and the reference, Japanese Patent Publication No. 5-32746 ("JP '746"), cited by the Examiner therein.

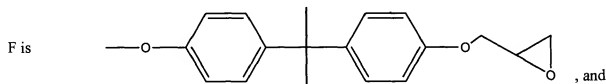
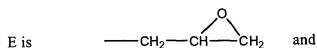
7. I supervised a set of comparative tests that demonstrated surprising advantages and superiority of succinic acid anhydride versus maleic acid anhydride in modified epoxy acrylates. The details of these comparative tests are set forth in the following paragraphs 8-14. The tests are summarized on the attached diagram, Exhibit A.

8. In Step 1, a post-glycidylated epoxy resin of formula II, named RT 1732, was manufactured from starting material, Araldit CT 7004, according to example 1, pages 14 to 16 in the above-referenced application. RT 1732 is a post-glycidylated epoxy resin of formula II:



wherein



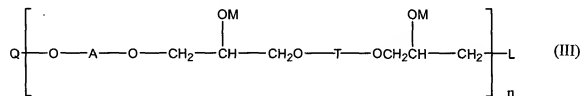


G is c. 90 mol % of the group

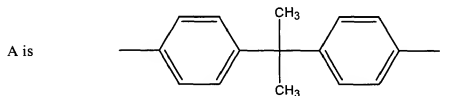


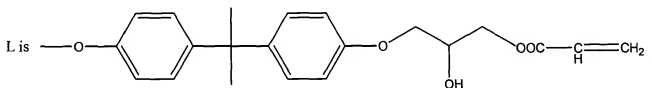
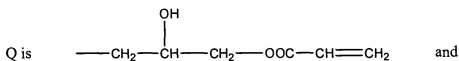
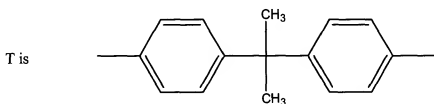
n has a mean value of 2.

9. In Step 2, an acrylated epoxy resin of Formula III, named RT 1743, was manufactured from the post-glycidylated epoxy resin RT 1732 formed in Step 1 according to the process described in example 10, pages 22 to 23 in the above-referenced application. RT 1743 is an acrylated epoxy resin of Formula III:



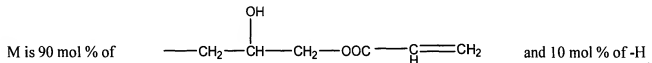
wherein





and

n has a value of c. 2.0 and



10. In Step 3, the epoxy acrylate RT 1743 was used to form a carboxyl group-containing epoxy acrylate of formula IV by three different synthesis routes. The three reactions are described in detail below as Steps 3a, 3b and 3c.

11. In Step 3a, RT 1743 was reacted with maleic acid anhydride in the presence of dimethylaminopyridine (catalyst) according to the method described in example 15, pages 25 to 26 in the above-referenced application. Specifically, 430g of dissolved resin RT 1743/26 (corresponding to 0.56 val secondary OH groups) from the acrylation addition (Step 2, paragraph 9 above) was stirred and heated to 100°C while air was passed through the reaction vessel to

inhibit polymerization. Next, 41g (0.42 mol) of maleic acid anhydride and 0.13g of dimethylaminopyridin were added. The reaction mixture was kept under stirring at a temperature of 105-110°C for seven hours. The solution turned brown quickly and formed a dark solid precipitate. The titration after six hours resulted in an acid value of 1.13 val/kg (theoretical value 0.887 val/kg) and the reaction mixture formed into a gel after an additional hour. The yield was a dark brown, solid and gel-like material, which was insoluble and could not be processed as a photoresist resin.

12. In Step 3b, RT 1743 was reacted with maleic acid anhydride in the presence of triphenylphosphine (catalyst) according to the method described in JP '746. Specifically, 366.23g of dissolved resin RT 1743/28 (corresponding to 0.50 val secondary OH groups) from the acrylation addition (Step 2, paragraph 9 above) was stirred and heated to 100°C while air was passed through the reaction vessel to inhibit polymerization. Next, 36.77g of maleic acid anhydride and 1.25g of triphenylphosphine were added. The reaction mixture was kept under stirring at a temperature of 105-110°C for six hours. The solution turned brownish black quickly. The titration after three hours resulted in an acid value of 1.24 val/kg (theoretical value 0.887 val/kg) and the reaction mixture formed into a gel after an hour. The yield was a dark brown, solid and gel-like material, which was so insoluble that cleaning of the reaction vessel was difficult. The gel could not be processed as a photoresist resin.

13. In Step 3c, RT 1743 was reacted with succinic acid anhydride according to example 15, pages 25 to 26 in the above-referenced application. The yielded reaction product

could be processed as a photoresist resin without any problems, as described in the next paragraph.

14. The product from Step 3c above (a carboxyl group-containing epoxy acrylate made from RT 1743 and succinic acid anhydride) was further processed as a photoresist resin composition through mixing and dissolving components according to the Application Example Formulation 1.1 on pages 27 to 28 of the above-referenced application. A cleansed copper-clad electronic laminate served as a substrate. All processing steps were carried out under protective yellow light. The formulation was coated with a wire applicator on the substrate. Drying was carried out in a circulating air oven. Exposure was made using a commercial apparatus with a 5000W mercury high-pressure radiation source doped with metal halide. Development was carried out in a commercial continuous development apparatus. Assessment of photosensitivity and resolution was made by exposure through a Stouffer step wedge and resolution wedge and the result was evaluated from the developed resist image.

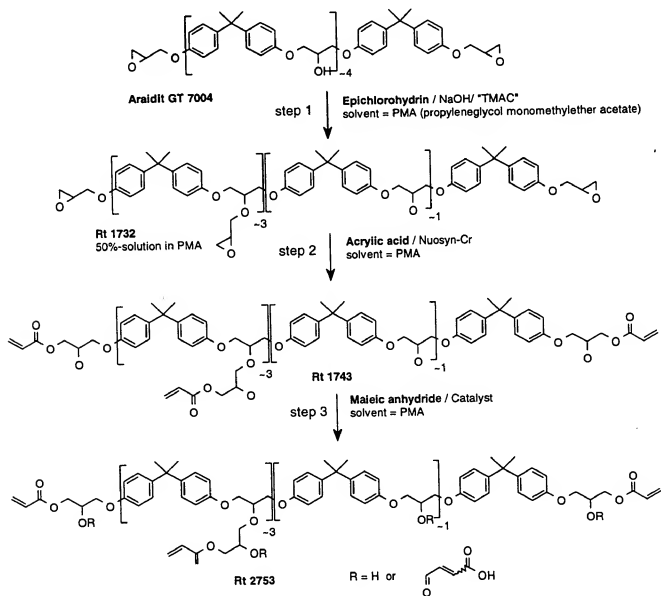
15. The photoresist resin composition described above in paragraph 14 (a succinic acid anhydride-modified epoxy acrylate) showed good viscosity for application, and photosensitivity of the last visible wedge step was 6. Modification of a postglycidylated epoxy acrylate with succinic acid anhydride was carried out without any problems and the photosensitive and water developable material was easily processed as a photoresist. This success was unexpected and the results were surprising compared to the modification of a postglycidylated epoxy acrylate with maleic acid anhydride, which produced a gel-like material that was insoluble and could not be further processed as a photoresist.

16. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements are made with the knowledge that willful false statements so made are punishable by fine or imprisonment or both under § 1001 of Title 18 of the United States Code and that such willful statements may jeopardize the validity or enforceability of this application or any patent issued thereon.



Dr. Roger ~~P~~ Pierre Salvin

08. 20. 03
Date



Step 3a: catalyst used: dimethylamino-pyridin

Step 3b: catalyst used: triphenyl phosphine